Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/84
FRANCE
February 1964
Original: FRENCH

Confidential until official release during Conference

Abstract

CRITICALITY STUDIES

by MM. D. BRETON - Département des Etudes de Piles - C.E.A. Saclay
R. CAIZERGUES - Département des Usines de Séparations Isotopiques C.E.A. SACLAY
C. CLOUET d'ORVAL - Département des Etudes de Piles - C.E.A. SACLAY
G. SOLLIER - Service de Construction des Usines de Traitement des Combustibles Irradiés - C.E.A. Montrouge
P. LECORCHE - Département des Usines de séparations Isotopiques C.E.A. SACLAY
J. MOREAU - Département des Etudes de Piles - C.E.A. SACLAY

(Commissariat à l'Energie Atomique, France)

Criticality studies made at the Commissariat à l'Energie atomique deal on the one hand with experiments on plutonium and uranium solutions, on the other hand with theoretical work on the development and use of computation methods for the resolution of problems concerning the nuclear safety of chemical and metallurgical plants.

I - Since 1958 the experimental studies have dealt with homogeneous media constituted by a fissile salt dissolved in light water. Developed using the reactor Proserpine, the experiments have been carried on at Saclay on the Alec-

Translation provided by courtesy of the submitting Government

to assemblies where solutions of plutonium or of 90 p. 100 - enriched uranium can be made critical.

The results already obtained relate to critical masses of cylindrical tanks of diameters from 20 to 50 cm, reflected in several ways (water, concrete, etc...) at concentrations up to 100 g/liter. Physical measurements (spectra, reactor noises) and interaction measurements complete the results.

Other experiments relating to plutonium solutions were begun in 1963 at the Valduc Center. They deal with the study of critical masses of annular vessels of external diameter 50 cm and internal diameter varying from 10 to 30 cm. These vessels can be water reflected internally, externally, or both. Two of these vessels have been studied in interaction for various geometries.

Slabs of various thicknesses were also studied.

II - The studies thus undertaken allowed the development of methods of computation which have been tested on several experiments. Particular use has been made of the possibilities of calculations based on transport theory and on Monte Carlo methods.

All these theoretical studies are applied to the design and control of industrial plants from the point of view of safety.

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/85
FRANCE
February 1964
Original: FRENCH

Confidential until official release during Conference

Abstract

CRITICALITY ALARMS - RECENT PROGRESS IN BURST SLUG DETECTION

by P. DESNEIGES

(Commissariat à l'Energie Atomique, France)

A - THE DETECTION OF CRITICALITY ACCIDENTS IN THE COMMISSARIAT A L'ENERGIE ATOMIQUE

by P. DESNEIGES - D.E./E.A.

G. DEBRIE - S.C.R.G.R.

J.M. LAVIE - S.C.R.G.R. M. PLANQUE - D.E./E.A.

In all installations where fissionable materials are handled in quantities virtually greater than the critical mass, there exists permanent risk of accidental nuclear excursion entailing a serious irradiation hazard to the personnel, in spite of all the precautions that might be taken. Immediate detection followed by rapid evacuation greatly limits the risks of irradiation due to the fission products or to the sustained nuclear reaction. Tne necessity for a suitable equipment for the detection of accidents of criticality is imposed by the fact that the physical phenomena accompanying a nuclear excursion are insufficient to follow the alarm, and may lead to confusion.

Taking into account the accidents which have occurred and the role expected from a detector, we choose a dose integration device for the detecting probe proper, and a system based on the coincidence of several informations to trigger the alarm. At the demand of the Commission des Masses Critiques, the minimal physical and electronical features required to obtain a very reliable system with minimal risk of false alarm has been established.

These features are described in some detail.

The equipment constructed at the Commissariat à l'Energie Atomique on the basis of these recommendations has been tested systematically under ac-

Translation provided by courtesy of the submitting Government

tual conditions of nuclear excursions at the Health Physics Research Reactor of the National Laboratory at Oak Ridge. These tests have served to determine two types of detection probes which will be described : a photomultiplier and a semi-conductor probe.

Finally the authors present an example of a complete unit for the detection of criticality accidents in an installation for the processing of fissile material.

B - THE EVOLUTION OF THE INSTALLATIONS FOR BURST SLUG DETECTION (B.S.D.) IN FRENCH REACTORS.

by R. DONGUY - D.E./E.A. R. LE MEUR - D.E./E.A.
J.P. SATRE - D.C.P. A. ROGUIN - D.E./E.A. J. MEGY - D.C.P.

The main part of the effort in the field of the Burst Slug Detection has been orientated on the large gas-cooled reactors where the problem of bursts slugs is associated with the economics of the plant.

The techniques developped during this programme can be subsequently adapted to easily solve problems of detection in other types of reactor.

The main characteristics of the evolution of the various installations constructed or under construction is reflected in the continuous progress towards greater automation and the use of detectors working under higher and higher temperatures and pressures.

Succeeding to the reactor G3 whose BSD installation was already highly automatic, the EDF reactors at CHINON use digital computers especially meant for BSD data processing. In the planned reactor EL 4, the BSD measurements will be processed with all the other control measurements in a centralized computer unit.

The progressive pressure increase of the cooling gas (15 bars in G3, 25 bars in the Chinon reactors, 60 bars in EL 4) has required the development of electric precipitations able to separate and measure the fission products in the carbonic gas at temperatures reaching 300°C and under pressures as high as 60 bars.

In spite of the severe conditions of utilisation, the various devices developed offer all the guarantees of safety and long life expectancy required for their use on BSD installations.

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/86
FRANCE
February 1964
Original: FRENCH

Confidential until official release during Conference

Abstract

THE TREATMENT OF EFFLUENTS

by MM. G. WORMSER
J. RODIER
E. de ROBIEN

(Commissariat à l'Energie Atomique, France)

For several years the French Atomic Energy Commission has been studying with interest problems presented by radio-active effluents.

Since high activities have not yet received a definite solution we will deal only, in this paper, with the achievements and research concerning low and medium activity effluents.

In the field fo the achievements, we may mention the various effluent treatment stations which have been built in France ; a brief list will be given together with an outline of their main new feactures.

Thus in particular the latest treatment stations put into operation (Grenoble, Fontenay-aux-Roses, Cadarache) will be presented.

From all these recent achievements three subjects will be dealt with in more detail

1 - The workshop for treating with bitumen the sludge obtained after concentration of radio-nucleides.

2 - The workshop for treating radioactive solid waste by incineration.

3 - A unit for concentrating radio-active liquid effluents by evaporation.

In the field of research, several topics have been undertaken, a list

Translation provided by courtesy of the submitting Government

will be given.

In most cases the research concerns the concentration of radionucleides with a view to a practical and low cost storage, a concentration involving an efficient decontamination of the aqueous liquids in the best possible economic conditions.

For improving the treatments leading to the concentration of nucleides, our research has naturally been concerned with perfecting the treatments used in France : coprecipitation and evaporation.

In our work we have taken into account in particular two conditions laid down in the French Centres.

1 - A very strict sorting out of the effluents at their source in order to limit in each category the volume of liquid to be dealt with.

2 - The necessity for a very complete decontamination due to the high population density in our country.

In the last past we present two original methods for treating liquid effluents.

1 - The use of ion-exchange resins for liquids containing relatively many salts.

The resins are used in the sodium form ; the regeneration is carried out using a sodium salt solution which, after decontamination by coprecipitation is used again. With this process it is possible to use a smaller volume of sludge.

2 - The use of a natural evaporator.

This process uses atmospheric air which is not saturated with water vapour and which is at a normal temperature, in order to extract water from the aqueous effluents.

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/87
FRANCE
February 1964
Original: FRENCH

Confidential until official release during Conference

Abstract

HEALTH PHYSICS PROBLEMS IN THE CONTEXT OF THE DEVELOPMENT OF INDUSTRIAL USES OF NUCLEAR ENERGY

by MM. F. DUHAMEL
A. MENOUX

(Commissariat à l'Energie Atomique, France)

The development of the industrial use of atomic energy has underlined the need to promote a rational and coherent doctrine relative to the safety of nuclear installations, with particular reference to nuclear sites.

The chief aim in the safety field is to reduce or even eliminate irradiation or contamination risks to the workers and the population due to normal or accidental functioning of the installations.

A complex set of safety methods is used, amongst which the authors take into particular consideration those which are to some extent independent of the type of installation : alarm and measurement systems and their setting in operation, technical and psychological training of individuals, estimation of the capacity of a site to "absorb radioactive wastes without damage to the population". It is obvious, in effect, that the consequences of an accident are diminished by the improvement of monitoring, measurement and alarm systems, by the raising of the technical level and by training of personnel and the education of the population.

This is particularly true near a nuclear installation, where a study of the danger is somewhat abstract in nature and the technological means of protec-

Translation provided by courtesy of the submitting Government

tion are many and complex.

From investigations to test the suitability of sites, it is possible to determine the diffusion or reconcentration parameters in the various natural media ; in this way the fate of radioactive effluents can be anticipated from the installation in which they have their source to man who may be exposed to them.

The organisation of radioactivity supervision on nuclear sites is very closely band up with these studies.

Amongst the many fields of investigation open, the following will be emphasized particularly :

- atmospheric diffusion experiments, the object of which is to determine the value of parameters established theoretically while at the same time taking account of complementary factors.
- hydrological, hydrogeological and oceanographical studies, from which the fate of radioactive ions in the hydrosphere may be determined.
- experiments and studies linked with the possibilities for disposal a underground storage of waste.

All these studies cover a complementary field, that of radioprotection, which forms the necessary link between nuclear safety proper, which concerns the actual operation of nuclear installations and medical supervision which directly concerns the health of the individual and the population. At the same time each one of the Health Physics disciplines possesses an independance which increases their efficiency on the safety level.

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/88
FRANCE
February 1964
Original: FRENCH

Confidential until official release during Conference

Abstract

THE PROCESSING AND MANAGEMENT OF WASTES FROM ATOMIC REACTORS

by M. P. CERRE

(Commissariat à l'Energie Atomique, France)

The policy concerning radioactive wastes studied by all Atomic Centres has led to various procedures which, while apparently numerous, come under a few standard headings.

Whether the wastes are in the liquid or solid state their management depends on their physical and chemical nature.

The procedure adopted is governed by three general principles :

- determination of the most economical means possible of storage and processing by volume reduction ;
- conversion to a solid compact form ;
- complete acceptance of the accepted standards at all places and all times.

In this communication all the standard solutions adopted and used by the various Centres of the Commissariat à l'Energie Atomique will be examined bearing in mind the preceding remarks.

Particular mention will be made of the following :

- For liquids, physical, chemical and physico-chemical processing
- For solids, decontamination, volume reduction and long-term conditioning techniques.

The different procedures for collecting and storing solid wastes before and after processing are also discussed.

The paper ends with a brief review of the studies, both technical and economic, being pursued on this subject.

Translation provided by courtesy of the submitting Government

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/89
FRANCE
February 1964
Original: FRENCH

Confidential until official release during Conference

Abstract

INFORMATION DERIVED FROM FRENCH STUDIES AND ACHIEVEMENTS IN THE FIELD OF URANIUM ISOTOPE SEPARATION

by MM. FREJACQUES
GALLEY
GUILLAUME
MARTIN
MASSIGNON
PECQUEUR
PLURIEN

(Commissariat à l'Energie Atomique, France)

The work carried out in the field of uranium isotope separation, by gaseous diffusion and by ultracentrifugation, is reviewed. An economic estimate of the various parameters involved in the cost is given, and it is shown that only very large gaseous diffusion plants, corresponding to a programme of enriched uranium reactors of at least 4000 MWe to be installed yearly, can give an economically acceptable enriched uranium production.

Translation provided by courtesy of the submitting Government